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TWENTY-SEVENTH

PROGRESS REPORT

OF

THE FIRESTONE TIRE & RUBBER CO.

ON

105 MM BATTALION ANTI-TANK PROJECT

Contract No.
DA-33-019-ORD-33 (Negotiated)
RAD ORDTS 1-12383

THE FIRESTONE TIRE & RUBBER CO.
Defense Research Division
Akron, Ohio
OCTOBER, 1952

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ABSTRACT

The changes in the distribution of the weapon systems manufactured by Firestone are given. One T137E3 rifle and one T152 E4 mount have been shipped to Allis-Chalmers Company for use on the ONTOS project. Nine additional rifles and five additional mounts for this project are to be furnished and are in process. Tests to compare the performance of the T88 and T57 primers are reported.

The emphasis on the T138 projectile development is now directed toward an improved accuracy at longer ranges. A future program is outlined.

Projectiles of the T119E8 and T119E11 types were fired to test the effect of design changes and low temperature (-40°F) on the functioning of the fin-opening mechanism, the strength of the components and on flight behavior.

The performance of the DRB398 cone in penetration tests is summarized and the effect upon performance of a number of variables has been determined. A future program for penetration studies is given.

Further tests have been conducted to determine the power generated by the fuze nose element, T223E3. The test procedures are discussed. Experiments with DRD328 fuze base elements for T222 E5 fuzes are reviewed.

THE WEAPON SYSTEM

Table I in the Twenty-Sixth Progress Report, giving the location and the component parts of the BAT weapon systems manufactured by Firestone, is still correct with the following exceptions:

(a) The two complete weapon systems (T137E3 rifles, T152E4 and T152E5 mounts, etc) shown as being at Aberdeen Proving Ground have been shipped to Fort Benning.

(b) A new weapon system duplicating each of the above systems has been shipped to Aberdeen Proving Ground.

Firestone has agreed to furnish ten T137E3 rifles and six T152E4 mounts for the ONTOS program.. One rifle and one mount have been shipped to Allis-Chalmers Co. Milwaukee, Wisconsin; four additional rifles and two additional mounts are planned for delivery early in November 1952; the remaining rifles and mounts, to complete the commitment, are planned for delivery during December.

T88 Primer

Tests have been conducted to compare the efficiency of the T88 primer with the M57 primer. The test data are summarized in Table I below.

The T88 primer shows two advantages over the M57 primer: (a) uniformity of recoil, and (b) smaller reduction of velocity over the temperature range 70°F to -40°F. (Reduced velocity temperature coefficient). Since the T88 contains only 300 grains of black powder instead of the 1000 grains in the M57, the T88 should have a still greater advantage at elevated temperatures.

The diameter of the T88 primer head is smaller than that of the M57. Therefore, the use of this primer in production rounds, would necessitate a reduction in the hole diameter in the shell case or an increase in the diameter of primer head. An adapter ring has been used for loading small quantities of rounds.

Table I
Test Data
T88 and M57 Primers

Primer	Temperature (°F)	Pressure* (lb/sq in)	Velocity* (ft/sec)	Recoil* (in)
M57	70	11,500	1744	14
T88	70	10,900	1740	8
M57	-40	8,700	1612	6
T88	-40	8,300	1623	7

*Each value is the average of three rounds.

T138 PROJECTILE

The emphasis on the T138 projectile development is being redirected. The original emphasis was to secure an accuracy of ±.5 mil at 1000 yards with a minimum penetration of 12 inches of armor. It is now desired to extend the range to 2000 yards with assurance of stable flight to still longer ranges, while retaining the same penetration requirement. It is known that the range of accuracy is limited when the round is fired from a rifle with a twist of 1-200 calibers. Certain developments in the field of shaped charges indicate that spin rates up to 60 or 70 revolutions per second can be used and still reach the penetration goal. As a consequence a series of programs using higher twist rates and modified tees are planned.

Future Program

1. Fire a group of T138E57A rounds from a rifle with 1-120 twist at a range of 2000 yards.

2. Fire a group of T138E57A rounds from a rifle with 1-80 twist at a range of 2000 yards.

3. Fire a group of T138 rounds, having tees modified internally but with the same external configuration, at a range of 2000 yards from a rifle with a 1-80 twist.

4. Fire a group of T138 rounds, having tees with the same internal configuration as 3, but with a 1/4-inch radius at junction of the boom and flange of the tee, at a twist of 1-80.

5. Fire a group of T138 rounds having tees with an external diameter of 1.481 inches and with modified internal shape from a 1-80 twist rifle.

6. Fire a group of T138 rounds, having tees modified so as to move the liner 1/4-inch rearward, from a 1-80 twist rifle.

Functioning and Flight Tests—T119E11 Projectile

During the month of October, projectiles manufactured to the latest modification, T119E11, were fired to test the effect of design changes on the fin-opening mechanism and on the flight characteristics of the projectile.

The functioning tests were required because the fin opening mechanism is powered by propellent gases which enter a chamber, through an orifice, at the rear of the projectile. When the projectile leaves the gun, the gases in the projectile chamber drive a piston rearward, forcing open the fins by means of a gear engagement between the piston and the fins. The T119E11 projectile has a gas chamber with greatly reduced volume over previous modifications. The orifice diameter was adjusted to compensate for the different chamber volume so that the projectile chamber pressure reaches the same peak value of approximately 4000 lb/sq in.

Three T119E11 rounds were fired through yaw cards into a recovery box and three rounds were fired down range for observation of flight. The range data are given in Table II and a chart describing the T119E11 projectile modification is shown in Table III. The recovered projectiles were in good condition, and fin opening was satisfactory as indicated by the fin cuts in the yaw cards. The projectiles fired down range were observed to fly well.

Low Temperature Tests

A group of T119 projectiles were fired at -40°F to determine the effect of extreme temperature on the strength of the projectile components and on the functioning of the fin opening mechanism. The projectiles were fired through yaw cards into a recovery box. The range data are shown in Table IV and Tables III and V describe the two projectile types listed, T119E8 and T119E11. Measurements of fin cuts on the yaw cards and inspection of the recovered projectiles indicate satisfactory performance of the rounds at -40°F.

T119 Projectile Shipments

Type	Date Shipped To Picatinny	Quantity
T119E8 HEAT	10-13-52	15
T119E8 Inert	10-22-52	17
T119E11 Inert	10-23-52	95
T119E11 HEAT	10-23-52	5
T119E11 Inert	11-1-52	175

Future Program

Continue the manufacture of 2500 T119 E11 rounds. It is planned to assemble these rounds in groups in the ratio of 100 HEAT to 200 Inert.

Table II
Functioning and Flight Tests
T119E11 Projectile

Date October 16 & 17 Program ________
FUNCTIONING & FLIGHT TESTS OF T119E11 PROJECTILE

PROJECTILE
Model T119
Type E11
Weight (Nominal) 17.70 lb
C.G. Location 6.9 in from hinge pin ℄
Bourrelet Dia (Nom.) 4.130 $^{-.002}$
Special Features Orifice Dia .196 in.
Projectile Chamber Volume
Approximately 11.4 Cu in

TEMPERATURES
MAGAZINE
Max 70°
Min 70°
Pres 70°
LOADING ROOM 75°
AMBIENT - 49°

TEST GUN
Model T137E3
Type 105 mm Recoilless Rifle
Length of Tube 105 in.
Twist of Rifling 1-20
Sighting Equipment M17 Mod Elbow Tel.
Bore Dia. (Lands) 4.134 $^{+.001}$ in
Electric Firing Used

T5351 Small Hole Cases
Polyethylene and Rayon Liners
M3 Gauges (1) only per case
M57 Primers

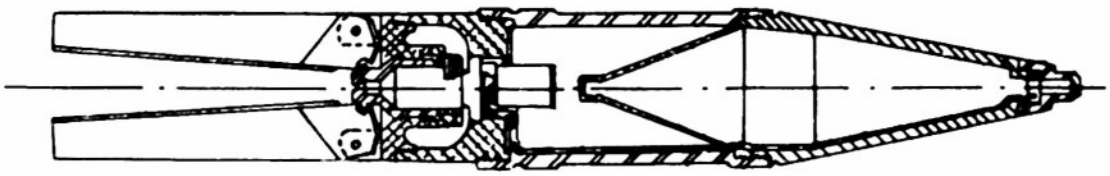
MISCELLANEOUS DATA
Range Recovery Box & 1029 Yds
Propellant PA 6119
Type M10MP web .038 in Charge Wt 8 lb 4 oz
Proof Director E. Huffman
Observers R. Hoee, J. Walter

Round No.	Proj No.	Proj. Weight	Powder Charge (lb oz)	Wind Vel. & Dir. (mph deg)	Chamber Pressure M3 Cu	Muzzle Velocity Instr.	Muzzle Velocity Actual[b]	Elev. (mils)	Azimuth (mils)	Position of Hit (inches) Vert.	Position of Hit (inches) Horiz.	Fin Spread[c] 1st Yaw Card Max.	Fin Spread[c] 1st Yaw Card Min.	Fin Spread[c] 2nd Yaw Card Max.	Fin Spread[c] 2nd Yaw Card Min.	Observations
3153	Slug		8-4													Rearward recoil was
3154	X204	17.70	8-4		10,700							10.69	10.62	10.69	10.62	off scale (over 23 in.)
3155	X203	17.70	8-4		11,300							10.75	10.62	10.79	10.66	
3156	X202	17.70	8-4		10,100							10.56	10.50	10.56	10.50	
Rounds 3153 to 3156 were fired on 10-16-52 into recovery box. All projectiles were recovered. T137E3 gun used.																
4026	Slug	17.27	7-14[a]					warm up round		PA 30240 propellant						All projectiles observed to have
4027	Slug	17.32	7-14[a]	9 - 50		1601	1629									good flight characteristics
4028	X208	17.72	8-8	9 - 50	9300	1608	1636	22.5	0	-14	-81					
4029	X207	17.72	8-8	10 - 45	8400	1572	1600	22.5	+2	missed						
4030	X209	17.72	8-8	9 - 70	9200	1633	1661	23.0	+2	missed						
Rounds X208, X207 and X209 were fired on 10-17-52 at the 1029 yd target. A T19 gun with 30° vents was used.																

a. For two warm-up slugs the following powder was substituted: PA 30240, Type M10MP, web .0335 in.
b. Retardation factor = .194 ft/sec/ft. Screen distances were: muzzle to first screen 72.5 ft, 1st to 2nd screen 110 ft.
c. Fin spread is determined from the cuts made in yaw cards by opposite fins and represents the maximum dimension across the fin tips. The calculated fin spread is: Max 10.82 in., Min 10.55 in.

Signed L.P. Sweebly

Table III
T119E11 Modification



Part	Dwg. No.	Material	Weight (lb.)
NOSE	DRC342	MALLEABLE IRON	3.49
BODY	DRC497	SAE1045	5.64
HOUSING	DRB573	24ST4	.95
CHAMBER	DRC442	24ST4	1.82
PISTON	DRB198	SAE1137	.54
STOP	DRA173	SAE1137	.09
FINS-CANTED	DRD334	14ST6 FORGING	1.02
PINS	.875X.2500	SAE1020	.07
NOSE CAP	DRA699	SAE1112	.21
PLUG	DRA670	24ST4	.11
CONE	DRB398	COPPER	.86
O-RING	DRA459	RUBBER	--
GAS SEAL	PICATINNY ARSENAL DWG. NO. 75-14-38 PcMKE	COPPER & LEAD	.02
BASE ELEMENT	DRA579	------	.33
WIRE & TAPE	DRA628	NYLON & COPPER	--
NOSE ELEMENT	DRA496	BARIUM TITANATE	.03
PIN STRIP	DRA454	BAKELITE	--
GROMMET	DRA492	NYLON	--
SHOCK PAD	DRA493	FELT	--
SHOCK PAD	DRA491	FELT	--
SLEEVE	DRA498	TURBOSIL SILICONE GLASS	--
WASHER			
R.C. ASSY	DRA598	-------	--
INSULATOR	DRA460	FELT	--
ASSEMBLY	DRD391	------	--
COMPOSITION B			2.79
PROJECTILE WEIGHT (CALCULATED)			17.97

C.G. 1.68 CAL. FROM HINGE PIN CENTER LINE, FINS OPEN
C.P. .68 CAL. FROM HINGE PIN CENTER LINE, FINS OPEN
TOTAL LENGTH - FINS CLOSED 28.08 IN.

NOTE: All components of T119E11 are identical with those of T119E10 with the exception of the body. The obturating band groove has been eliminated from the new body to permit firing of the T119E11 projectile from rifled tubes.

Table IV
Low Temperature Data
T119E8 and T119E11 Projectiles

Date Oct 8-21, 1952 Program T119C2

PROJECTILE
Model T119
Type E8 & E11
Weight (Nominal) 17.60 lb
C.G Location ______
Bourrelet Dia (Nom.) 4.130 in. -.002
Special Features Bands Machined Off
On E8 projectiles Blunt Noses

TEMPERATURES
Box -40°F
Ambient +40°F

TEST GUN
Model T137E1 & E3
Type 105mm Recoilless
Length of Tube 105 in
Twist of Rifling 1-200 & 1-20
Sighting Equipment M17 Mod Elbow Telescope
Bore Dia. (Lands) 4.134 +.001

Tube No 22B 536-B
Chamber 21B 133 E
Breech 22B 2498
T137E1

SCREEN DISTANCES
47'1" 62'6"

MISCELLANEOUS DATA
Range Recovery Box
Propellant
*PA-30240 Type M10MP web .0335 in Charge Wt. 8 lb 1 oz
**PA-E-6119 Type M10MP web .038 in Charge Wt 8 lb 2 oz
Proof Director E. Huffman
Observers ______

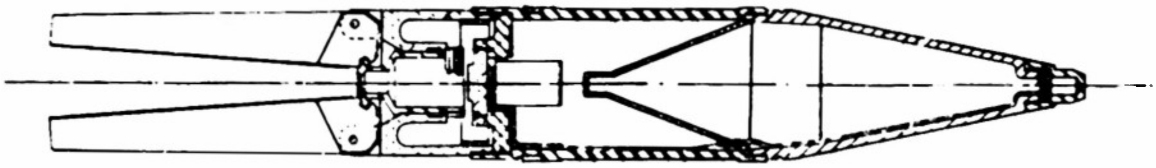
T53 Case, Polyethylene Liner with T137E1 Rifle
M67 Primer (2) M3 Gauges per case
T53E1 Case Polyethylene Liner with T137E3 Rifle

Rd No	Proj. No.	Proj. Type	Proj Weight	Powder Charge	Recoil	Chamber Pressure	Muzzle Velocity Instr	Muzzle Velocity Actual		Ambient Temp (°F)	Round Temp	Fin Spread (in) 1st card	2nd card	3rd card	Date Fired	
3086	X201	E8	17.58	8-1*	17 in Rear	9800 6600?	No Reading			68°	-40°F	10.75	10.60	10.75	10-8-52	
3087	X200	E8	17.66	8-1*	16 in Rear	9100 10200	1624	1639		60°	-40°F	10.75			10-11-52	This projectile
The above rounds were fired from the T137E1 gun with 1-200 rifled tube																
3025	X205	E11	17.70	8-2**	14 in Rear	9000 8600	1641	1672			-40°F	10.75	10.50	10.75	10-21-52	
3026	X206	E11	17.70	8-2**	18½ in Rear	10200 10200	1646	1678			-40°F	10.62	10.60	10.60	10-21-52	
The two rounds above were fired from the T137E3 gun with 1-20 rifled tube																

a The complete rounds were left in a cold box at -40°F for 12 hours.
b Electric firing system was used
c All projectiles were recovered
d Performance was satisfactory
e Fin spread is determined from the cuts made in yaw cards by opposite fins and represents the maximum dimension across the fin tips. The calculated fin spread is maximum - 10.82 in, minimum - 10.66 in

Signed - L.P. Sweebly

Table V
T119E8 Modification



Part	Dwg. No.	Material	Weight (lb.)
NOSE	DRC-342	MALLEABLE IRON	3.49
BODY	DRC-341	SAE1045	5.58
HOUSING	DRC-412	24ST4	1.76
PISTON	DRB-198	SAE4140	.52
STOP	DRA-173	SAE4140	.09
FINS	DRD-334	24ST4 FORGING	1.01
PINS	DRA-730	SAE1020	.06
NOSE CAP	DRA-699	SAE1030	.21
PLUG	DRA-288	24ST4	.11
PLUG	DRB-419	24ST4	.58
OBTURATING BAND	DRB-420	COPPER	.20
CONE	DRB-398	COPPER	.90
O-RING	Ckcx3-1/8" x 3 7/8"	RUBBER	.01
GAS SEAL	PICATINNY ARSENAL DWG. 75-14-38 PcMKE	COPPER & LEAD	.03
BASE ELEMENT	DRA-579	------	.33
WIRE & TAPE	DRA-628	NYLON & COPPER	--
NOSE ELEMENT	DRA-496	BARIUM TITANATE	.02
PIN STRIP	DRA-454	BAKELITE	--
GROMMET	DRA-492	NYLON	--
SHOCK PAD	DRA-493	FELT	--
SHOCK PAD	DRA-491	FELT	--
SLEEVE	DRA-498	TURBOSIL SILICONE GLASS	--
WASHER			
R. C. ASSY.	DRA-598	------	--
INSULATOR	DRA-460	FELT	--
ASSEMBLY	DRD-262		
COMPOSITION B			2.79
PROJECTILE WEIGHT (CALCULATED) 17.82 LBS.			

C. P. .68 CAL. FROM HINGE PIN CENTER LINE, FINS OPEN
C. G. 1.73 " " " " " " " "

TOTAL LENGTH- FINS CLOSED 28.21 IN.

Performance of the DRB 398 Cone

The Twenty-Third, Twenty-Fourth, Twenty-Fifth and Twenty-Sixth Progress Reports contained some information on the performance of the DRB398 cone. These data, together with some previously unpublished data, are summarized in this report. Fig. 1 is a drawing showing the DRB398 cone. The effect, upon performance, of a number of variables has been determined. The variables tested are as follows:

(1) Method of Manufacture
 (a) "as drawn"
 (b) drawn and recoined to smooth out the small waves left by the various steps in the drawing operation,
 (c) machined from hard drawn copper bar.

(2) Cone Material; Copper and Aluminum

(3) Type of Body Assembly
 (a) DRC376 test body, Fig. 2.
 (b) DRC376 test body with DRC 314 tee, Fig. 3.
 (c) DRC321 body with DRC314 tee, Fig. 4.

(4) Location of Booster, Fig. 5
 (a) in the base plug
 (b) in a base element cavity in the high explosive.

The penetration data for all copper cones are summarized in Table VI. The spin rate curves are shown in Figs. 6 and 7.

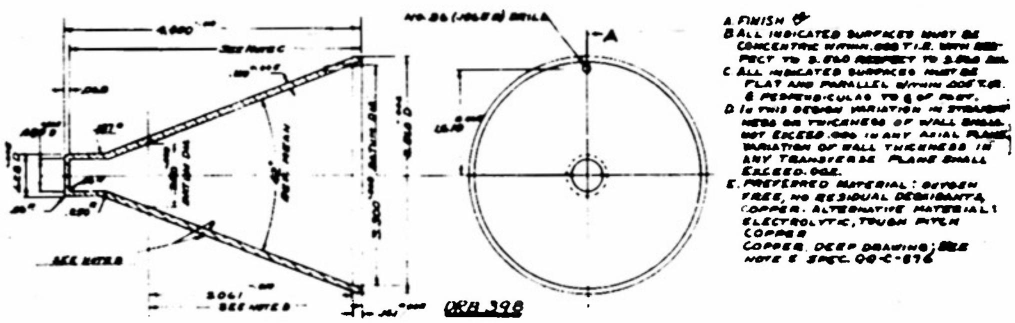


Fig. 1. DRB398, 42 Degree Copper Cone.

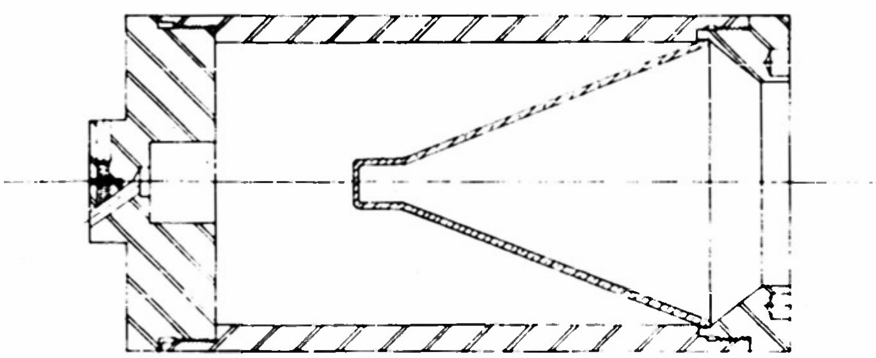


Fig. 2. Penetration Assembly.
DRC376 Assembly, DRB398 Pressed Cone.

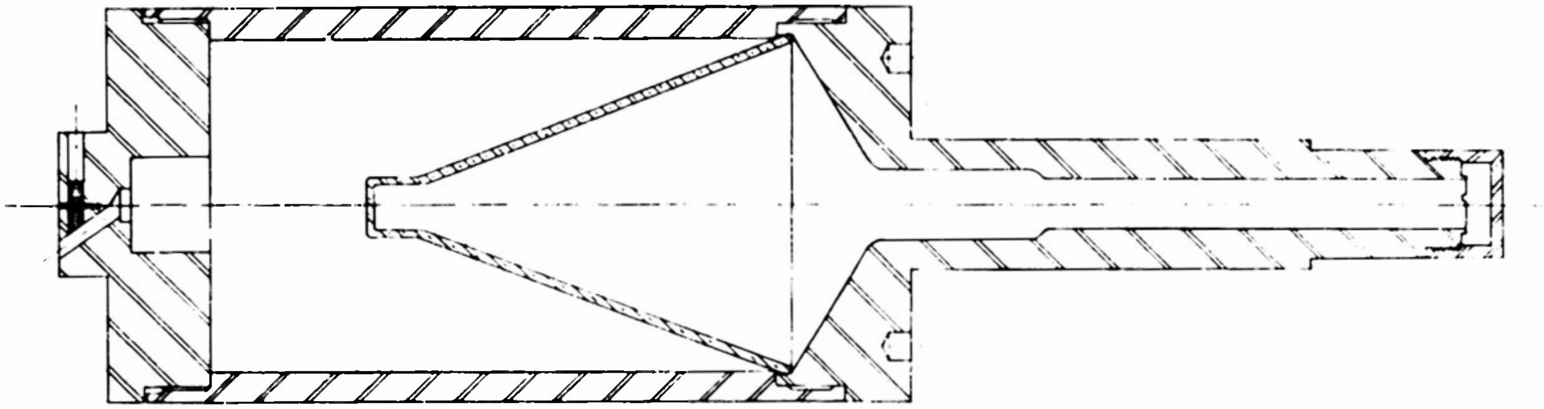


Fig. 3. Penetration Assembly.
DRC376 Assembly, DRB398 Pressed Cone.

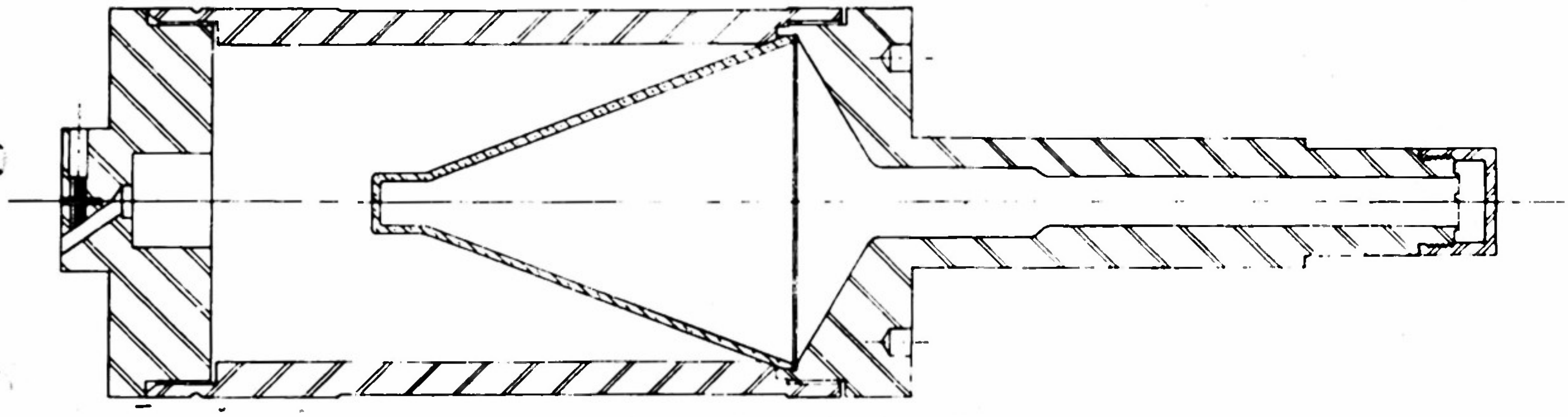


Fig. 4. Penetration Assembly.
DRC321 Body, DRB398 Pressed Cone.

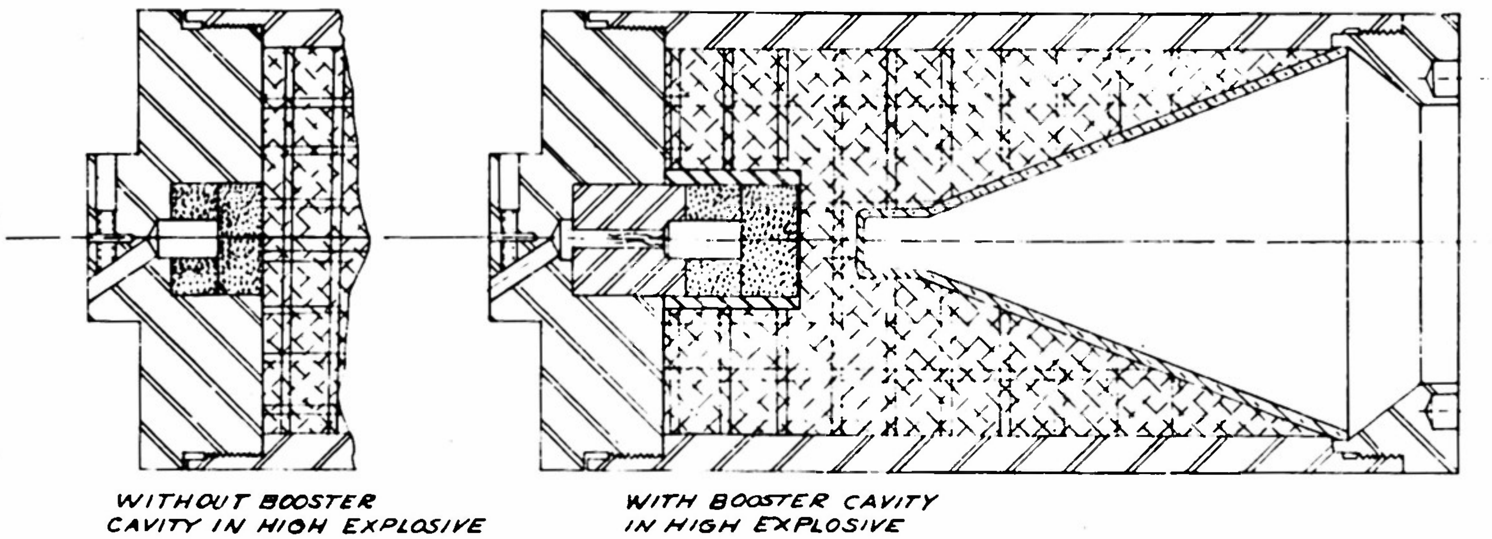


Fig. 5. Penetration Test Assemblies.
Booster Cavity Location.

Table VI

Penetration Data, DRB398 Copper Cones

Body	Cone	Penetration (inches M.S.)	No. Rds.	Std. Dev.
I. Nose Rings, Booster in Base Plug.				
a. DRC376	Drawn	21.00	24	±1.01
b. DRC376	Machined	20.83	4	±0.40
c. DRC321	Drawn	20.80	10	±0.43
II. Nose Rings, Booster in Base Element Cavity in Comp B.				
a. DRC376	Drawn	19.96	15	±1.02
b. DRC376	Machined	19.45	5	±0.48
c. DRC376	Recoined	19.63	5	±0.78
III. DRC314 Tees, Booster in Base Plug.				
a. DRC376	Drawn	16.83	3	±0.80
b. DRC321	Drawn	15.71	8	±1.36
IV. DRC314 Tees, Booster in Base Element in Cavity in Comp B.				
a. DRC376	Drawn	16.30	5	±0.29
b. DRC321	Drawn	15.22	9	±0.87

V. Effect of Rotation

Spin Rate	Nose Ring		DRC314 Tee
	Booster in Base Plug	Booster in Cavity in H.E.	Booster in Cavity in H.E.
-25	16.38 (14)		
-15	19.38 (14)		
0	20.98 (28)	19.79 (25)	15.61 (14)
25	16.09 (14)	14.40 (19)	14.39 (14)
30	13.85 (5)	12.29 (8)	12.94 (2)
45		11.00 (5)	
60		7.21 (3)	

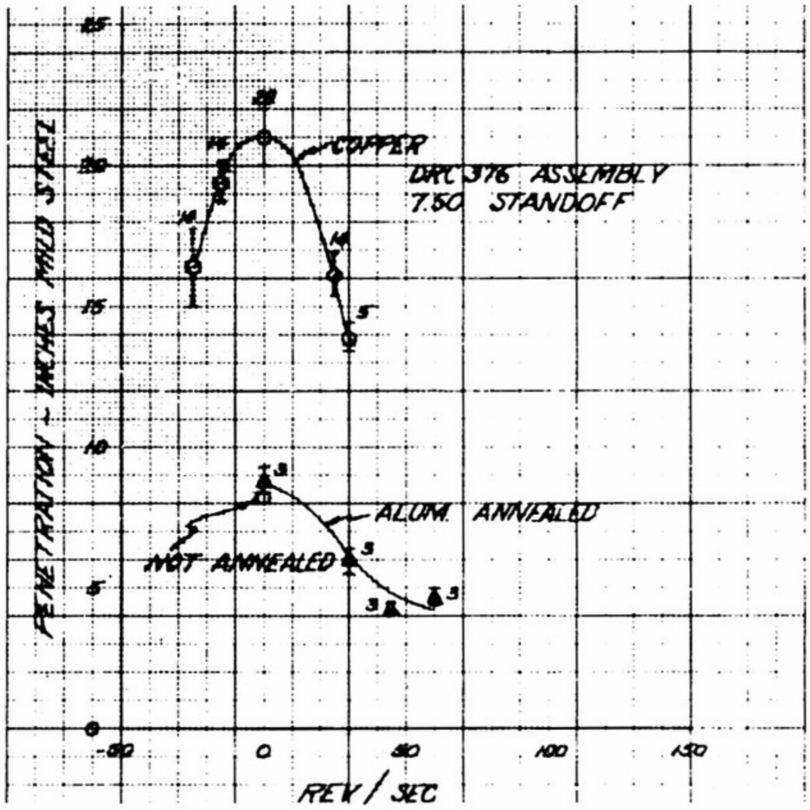


Fig. 6. Spin Rate Versus Penetration.
Nose Rings No Base Element Cavity.

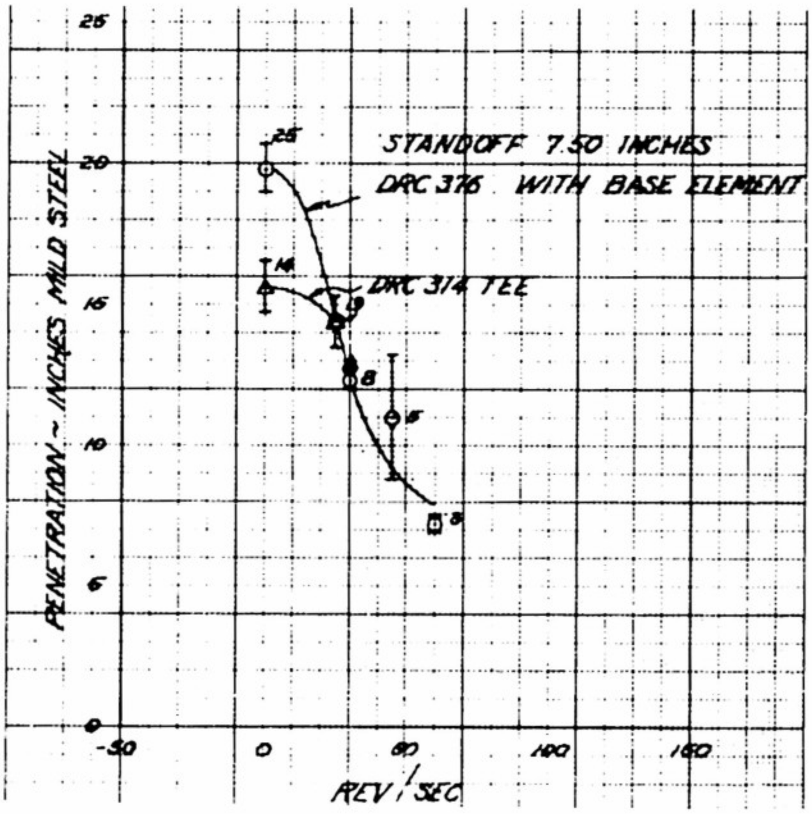


Fig. 7. Spin Rate Versus Penetration.
Nose Rings and Tees With Base Element Cavity.

The following conclusions have been made from these data and apply specifically to the use of the DRB398 copper cone.

(1) DRD321 and DRC376 bodies may be used interchangeably in static penetration tests.

(2) The DRC314 tee seriously reduces the penetration of non-rotated rounds.

(3) Method of cone manufacture - "as drawn", drawn and recoined or machined from bar stock - has no effect upon penetration of test assemblies without tees when fired at a 7.50-in. standoff.

(4) Booster location is important to penetration. The test procedure, in which the booster is placed in the base plug, allows [illegible] in. more penetration than does the projectile procedure in which the booster and base element are buried in the explosive.

Effect of Tee Configuration

The study of the effect of internal tee configuration upon penetration has continued. Fig. 8 shows the modification DRC314HW11. Penetration data are shown in Table VII.

Since the unmodified DRC314 tee permits a penetration of only 16.83 in. (Twenty-Sixth Progress Report) and the nose ring allows 21.00 in. penetration, it is apparent that this modification to the tee represents a substantial improvement in performance. Further tests are planned.

Effect of Aluminum Cones (DRB 398)

DRB398 cones have been machined from 24S-T6 aluminum bar. All but three were completely annealed after machining. The spin rate-penetration data are shown in Table VIII and Fig. 6. The aluminum cones are only 42% as efficient in penetration as copper cones. Annealing appears to have very little effect.

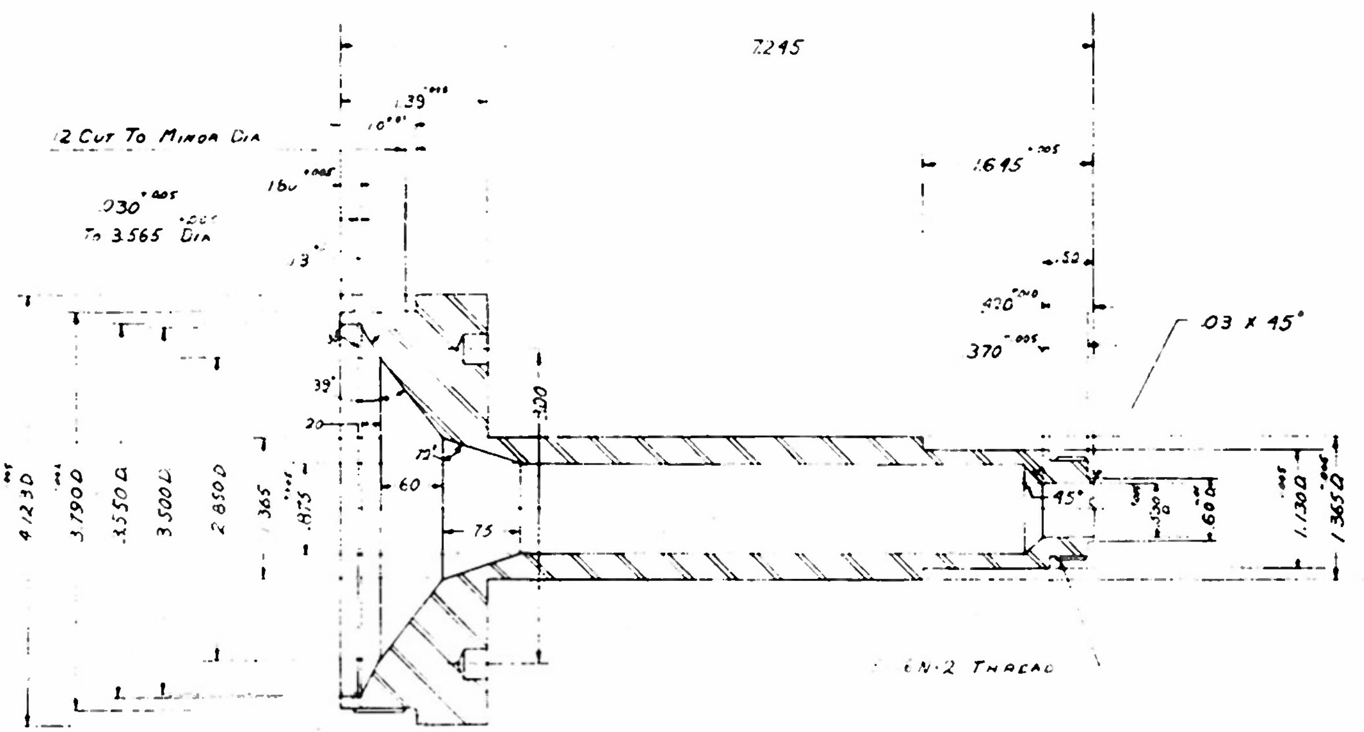


Fig. 8. DRC314 HW11 Tee.

Table VII

Penetration Data

With DRC314 HW11 Tees

Round No.	Lbs.Comp B	Rev/Sec	Penetration (in.)	Max.Spread (in.)	Std. Dev. (in.)
Q767	2.60	0	19.94		
Q768	2.58	0	18.75		
Q769	2.60	0	19.62		
Q770	2.62	0	19.18		
Q771	2.63	0	21.18		
			Avg. 19.73	2.43	±.93

Notes:
(1) DRC376 bodies and plugs; booster pellets in base plug.
(2) Loaded at Ravenna Arsenal, BAT Lot No. 20 with Comp. B from Holston Lot No. 3-126.

Table VIII

Penetration Data

DRB398 Cones (Aluminum)

Round No.	Lbs.CompB	Rev/Sec	Penetration (inches M.S.)	Max.Spread (in. M.S.)	Std. Dev. (in. M.S.)
FS365'	2.44	0	8.50		
FS366'	2.46	"	7.62		
FS367'	2.42	"	8.50		
			Avg. 8.21	.88	±.51
FS356	2.44	0	9.18		
FS359	2.44	"	9.00		
FS360	2.48	"	8.06		
			Avg. 8.75	1.12	±.60
FS354	2.42	+30	5.50		
FS355	2.44	"	6.38		
FS357	2.44	"	5.94		
			Avg. 5.94	.88	±.44
FS353	2.44	+45	4.44		
FS358	2.42	"	4.12		
FS364	2.44	"	4.18		
			Avg. 4.25	.32	±.17
FS361	2.44	+60	4.44		
FS362	2.46	"	5.06		
FS363	2.48	"	4.56		
			Avg. 4.69	.62	±.33

Notes:
1. Cones were machined from aluminum bar Alloy No. 24S-T6. All but FS365, 366, 367 were annealed prior to testing.
2. All cones were assembled in DRC376 test assemblies and loaded at Ravenna Arsenal, BAT Lot No. 9 with Comp B from Holston Lot 3-126.
3. All rounds were detonated at a standoff of 7.50 inches.

Future Program

1. Conduct penetration versus standoff tests for 45° and 20° copper cones (100-inch wall) with head of H.E. held constant at 3.63 in.

2. Evaluate the influence of DRC 314 tees made of (a) mild steel (b) high ductility malleable iron, and (c) low ductility malleable iron.

3. Continue tests to determine the effect of interior tee configuration upon penetration.

4. Continue scaling studies with smaller liners.

5. Composite cones. The penetration behavior of steel and of aluminum cones each with thin copper inserts, and of copper cones with thin aluminum inserts, is being compared with homogeneous copper cones. Initial tests will be at 0 and 25 rev/sec.

FUZES

T222E3 (DRA 496-2) Nose Element Crystal Assemblies

The program to investigate the power generated by the fuze nose element upon impact has continued.

Test slugs weighing fifteen pounds have been fired from a 75mm gun at T138E57 tee assemblies containing T222E3 crystal assemblies. In each case a BS28 indicator and an oscilloscope were connected in parallel across the crystal. In an effort to secure a more easily photographed trace a different (5xP11) cathode ray tube was used in the oscilloscope.

From four rounds which struck the tee squarely, one satisfactory picture was obtained. Of the other three, one picture was overexposed (the BS28 indicator functioned) but the remaining two rounds (nos. 4 and 7) showed no trace and did not function BS28 indicators. These two rounds are the first to fail to function BS28 indicators in approximately thirty tests. The good photograph (no. 9) showed a maximum voltage of 875 volts which decayed to zero in 5.7 microseconds. This result is consistent with values obtained on previous firings.

The energy output of the crystals is related to the capacity and voltage by the equation

$$E=1/2\ CV^2$$

The average voltage can be determined from the photographs of the traces. This voltage can be used to determine the energy. The capacity of the crystal must be determined.

Attempts are being made to measure the charge produced, by use of a ballistic galvanometer as a further check on the output of the crystal system.

Base Elements (DRD 328) for T222E5 Fuze

The Twenty-Sixth Progress Report gave data on the firing of six DRD328 base elements (Fig. 10 of Twenty-Fifth Progress Report). Six T138E57 projectiles equipped with DRD328 base elements and spotting charges were fired at bursting screens placed at ranges of from 75 to 200 ft. In five the spotting charge failed to function. The sixth was fired into the recovery box and when examined was found to be unarmed.

Thirteen T138E57 projectiles with DRD328 base elements from a new lot were prepared for firing, using T18 detonators, tetryl pellets and spotting charges. These base elements were tested twice in the centrifuge and were found to function normally before assembly into the rounds for firing. Three of the rounds were fired at a 3 1/4-inch wood bursting screen at a range of 75 ft and did not function. Two rounds were fired at the same screen at a range of 125 ft and did not function. A 1/4-in steel plate was then erected as a bursting screen at a range of 75 ft. Three rounds fired against this steel bursting screen also failed to function. Three rounds were then fired into a recovery box after removing the tetryl pellets and the spotting charges. Upon recovery it was found that they had not armed. Subsequent tests showed that the three recovered base elements did not function in the centrifuge. Cross sectioning of one of the elements through the plane of the three pins showed that the depth of the holes was not to specifications and that the number one pin could deflect too far and cause the number two pin to bind. A simple modification to the number one pin will eliminate this defect. The remaining two base elements were so modified and taken to Erie Ordnance Depot and fired into the recovery box. Upon recovery, examination revealed that the two base elements had armed. Therefore, a new lot of DRD328 base elements are being modified and the test is to be repeated. An additional advantage of the modified pin is that the hole depths may have a larger tolerance and still have satisfactory performance.

Application of M500 Fuze to T119 Projectile

One of the fuzing requirements for the BAT project specifies a fuze capable of giving a time delay which may be varied from 1.5 to 30 seconds. The M500 fuze, a standard ordnance item is capable of meeting these requirements. The size of this fuze prevents its application to the T138E57 projectile but a simple adapter permits its use in the ogive of the T119 projectile. Although the delay mechanism is satisfactory for use in the T119, the point-detonating portion of the fuze will not arm at a spin rate less than 1500 rev/min. An attempt will be made to substitute the three pin system of the DRD328 base element in the point detonating part of the M500 fuze so that it will arm from the setback force rather than the spin rate. Models are being made for testing.